



# UNITED STATES PATENT AND TRADEMARK OFFICE

OK

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/010,704	11/13/2001	McDonald Robinson	Lawrence 712	8430
7590	03/10/2004		EXAMINER KIELIN, ERIK J	
Robert Moll 1173 St. Charles Court Los Altos, CA 94024			ART UNIT 2813	PAPER NUMBER

DATE MAILED: 03/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

10/010,704

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/010,704	ROBINSON ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Erik Kielin	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 02 January 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1 and 49-73 is/are pending in the application.
- 4a) Of the above claim(s) none is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 49-73 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

## DETAILED ACTION

This action responds to the Amendment filed 2 January 2004.

### *Claim Rejections - 35 USC § 102/103*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 49-53 and 54-60 and 61-67, and 68-73 are rejected under 35 U.S.C. 102(e) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over US 5,357,899 (**Bassous et al.**).

Regarding independent claims 1, 54, 61, and 68-73, **Bassous** discloses growing one or more epitaxial layers on a silicon crystal substrate (col. 5, lines 55-56), at least one of which is a Si-Ge-C layer, wherein the carbon of the Si-Ge-C layer is an amount sufficient to exhibit etch selectivity with respect to the single crystal silicon substrate and/or one or more of the epitaxial layers adjacent the Si-Ge-C layer (col. 3, lines 1-20); and etching the Si-Ge-C layer with a liquid

Art Unit: 2813

etchant, and the single crystal silicon substrate and/or one or more of the epitaxial layers adjacent the Si-Ge-C layer (col. 2, lines 54-66; col. 5, lines 55-65). The carbon concentration is implicitly taught in **Bassous** to be, about 3% to about 30%. Rationale follows: Regarding the boron and carbon concentration in the Si, **Bassous** states,

“The silicon material is grown epitaxially using UHV/CVD (ultra high vacuum chemical vapor deposition) or APCVD (atmospheric pressure chemical vapor deposition) at low temperature (from about 500 °C to 850 °C) and doped with boron in a concentration range **greater** than  $2 \times 10^{20}$  atoms per cubic centimeter (e.g. **10 to 100 times greater than that of conventional high temperature epi silicon**)... Atoms such as carbon are smaller than silicon atoms, like boron, and produce tensile stress on the membrane. The result is a stress compensation, defect free, transparent membrane.” (See Bassous, col. 3, lines 2-20. Emphasis added.)

Bassous states that the conventional amount is

“The epitaxial membrane film is **grown by conventional methods, i.e. at high temperature (at or above 1,000 °C)**, and on one side of the wafer only. The process is limited in the range of boron and germanium concentrations, **allowing concentrations of boron up to only  $2 \times 10^{20}$  atoms/cm<sup>3</sup>** (approximately 1 atom of boron per 250 atoms of silicon) and of germanium up to only  $5 \times 10^{20}$  atoms/cm<sup>3</sup> (approximately 1 atom of germanium per 100 atoms of silicon).” (See Bassous, col. 1, lines 2-20. Emphasis added.)

Accordingly, the concentration of boron indicated in **Bassous** is, expressly, “10 to 100 times **greater than** the conventional amount of  $2 \times 10^{20}$  atoms/cm<sup>3</sup> **or 10 to 100 times the 1 boron per 250 silicon atoms which equals 10 to 100 boron atoms per 250 silicon atoms or about 4% to 40% boron**. Given that the covalent radius of carbon atoms (0.91 Å) --being only 78% of that radius of boron (1.17 Å)-- would generate greater tensile stress in silicon if equal amounts were used. This suggests that the amount of carbon used would be somewhat less than that amount of

boron to give an equivalent effect on the tensile stress. This point is admitted to by Applicant; see for example the REMARKS filed 6 November 2003, p. 9, lines 17-22, for example.)

As a consequence, one of ordinary skill would implicitly determine the concentration of carbon to be based upon its relative volumetric difference from boron, since it is the volumetric difference between silicon atoms and either of the carbon or boron atoms that determines its impact on the tensile stress of the silicon. Using the equation for the volume of a sphere,  $V=4/3\pi r^3$ , to approximate the volume of the boron and carbon atoms, the volume ratio of carbon to boron is  $0.91^3/1.17^3 = 0.47$ . From this result, it is clear that carbon takes up only 47% of the space of boron. Accordingly, one of ordinary skill would know that carbon in an amount of 47% of the amount of boron would achieve the equivalent reduction in volume of the silicon and thereby the equivalent effect on the tensile stress of silicon.

Given the disclosed boron concentration of 10 to 100 per 250 silicon atoms, as noted above, the equivalent carbon concentration would be about 0.47 times (10 to 100 atoms) or 4.7 to 47 carbon atoms per 250 atoms of silicon or 1.9% to 19%, which overlaps the 1% to 10% presently claimed. Note that it has been held that "in considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom." *In re Preda*, 401 F.2d 825, 826, 159 USPQ 342, 344 (CCPA 1968) See also *In re Lamberti*, 545 F.2d 747, 750, 192 USPQ 278, 280 (CCPA 1976). One of ordinary skill would be able to infer from the disclosed quantity of boron and its impact on tensile stress to estimate the amount of carbon needed to produce a similar effect on the silicon, as it is based upon a simple volumetric ratio.

However, if it is thought that the concentration of carbon is not implicitly disclosed in **Bassous**, then this may be a difference. The amount of carbon --considered with the disclosed amount of boron used in the Si layer-- would be obvious to one of ordinary skill to use in appropriate relative amount to boron, because **Bassous** teaches that carbon, like boron, may be used and has the same impact on generating tensile stress in the silicon as does boron. (See excerpts from **Bassous** above.) In this regard, the amount of carbon is obvious according to precedent. See for example, *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious). One of ordinary skill would be motivated to use the amount of carbon indicated above to achieve the same impact on the tensile stress as an the disclosed amount of boron.

Regarding claims 49, 55, 62, and further regarding claims 68, 70, and 72, the Si-Ge-C layer etches slower than the one or more adjacent epitaxial layers. Note that since the adjacent epitaxial layers are not being etched at all, the etch rate is zero and is therefore etching slower than the Si-Ge-C layer. Moreover, as presently written, there exists no requirement in these claims for the epitaxial layer to be etched at all, given the “and/or” phraseology. Accordingly, as long as the substrate is being etched at a different rate from that of the Si-Ge-C, this limitation is still met, regardless of the relative etch rate of a layer which is not required to be etched. This rejection may be overcome by making a positive statement requiring etching of the one or more adjacent epitaxial layers.

Regarding claims 50, 56, and 63 the Si-Ge-C layer 14 etches slower than the single crystal silicon substrate 10 in Figure 1C.

Regarding claims 51, 57, 64, and further regarding claims 69, 71, and 73, as presently written, there exists no requirement in these claims for the epitaxial layer to be etched at all, given the "and/or" phraseology. Accordingly, as long as the substrate is being etched at a different rate from that of the Si-Ge-C, this limitation is still met, regardless of the relative etch rate of a layer which is not required to be etched. This rejection may be overcome by making a positive statement requiring etching of the one or more adjacent epitaxial layers.

Regarding claim 52, 58, and 65, the Si-Ge-C layer 12 etches faster than the single crystal substrate 10 in Figure 1B.

Regarding claims 53, 60, and 67, the etching includes applying KOH (col. 5, lines 55-65).

Regarding claims 59 and 66, the single crystal substrate is made of silicon (col. 5, lines 60-5).

### ***Double Patenting***

4. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

5. Claims 1 and 49-73 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-6 of U.S. Patent No. 5,906,708. Although

Art Unit: 2813

the conflicting claims are not identical, they are not patentably distinct from each other because each claims the use of Si-Ge-C as an etch stop relative to single crystal silicon substrate or adjacent epitaxial layers using a liquid etchant of KOH and wherein the carbon content in the etch stop layer is 1-5% or greater than 2% which makes the range 1-10% obvious.

### ***Response to Arguments***

6. Applicant's arguments with respect to all claims have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

This action is made non-final to give Applicant the opportunity to respond to the new grounds of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 571-272-1693. The examiner can normally be reached on 9:00 - 19:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.



Art Unit: 2813

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Erik Kielin  
Primary Examiner  
7 March 2004